LETTER OF AGREEMENT
BETWEEN
UNITED STATES DEPARTMENT OF AGRICULTURE,
AGICULTURUAL RESEACH SERVICE
AND
NATURAL RESOURCES CONSERVATION SERVICE

WHEREAS, United States Department of Agriculture, Agricultural Research Service, hereinafter known as ARS, and the Natural Resources Conservation Service, hereinafter known as NRCS, desire to enter into this Letter of Agreement, hereinafter known as Agreement, to complete development and testing of the ARS Wind Erosion Prediction System, version 1.0, hereinafter known as WEPS 1.0; and

WHEREAS, ARS' interest is to develop and test WEPS 1.0; and

WHEREAS, NRCS' interest is to test and implement WEPS 1.0 nationwide; and

WHEREAS, Both parties understand that this Agreement only pertains to the development and testing of WEPS 1.0 and that transfer of WEPS 1.0 to NRCS by ARS will be done under a separate agreement;

NOW, THEREFORE, ARS and NRCS agree as follows:

PHASE ONE: WEPS 1.0 DEVELOPMENT
Start Date: July 1, 2002
End Date: June 30, 2003

A. ARS' REPONSIBILITIES

1. Complete the user interface and user documentation. WEPS 1.0 will be delivered with its current graphical user interface free of any serious bugs affecting usability (including memory leaks) with the following improvements as listed below.

Finish the online help code component.
Populate all context sensitive help files. Gary Tibke will review relevancy of help information for NRCS users.
Complete WEPS 1.0 User's Guide. Gary Tibke will review relevancy of content for NRCS users. See Attachment 1 for User's Guide table of contents.
Fix MCREW timeline view to display different icons for different classes of management operations.
Improve MCREW editing functionality. Provide the capability to: 1) "insert" additional management rotation file content at selected tableview row location; 2) select multiple management operations within the table view and perform specific editing functions on them as a group (cut, copy, paste, delete, and increment/decrement their operation dates); 3) change the start rotation year of multi-year rotations; and 4) automatically increase the "number of years in a rotation" to match the current rotation file contents.
Replace dropdown choice lists in MCREW with the Java FileChooser dialog.
Fix MCREW popup calendar so that it always fully displays onscreen.

Modify management and crop database formats so that they consist of individual records under a hierarchical directory structure rather than a single database file consisting of multiple records.

Revise and update the tabular Output Reports. Provide: 1) output printing in a larger font size; 2) redefine the tabbed options to include erosion, weather, above ground biomass, and soil surface condition subreports; 3) additional erosion output which delineates the loss from the active saltating and deposition regions and their areas; 4) soil surface aggregate size distribution and stability output; 5) WEPS 1.0 Project and Run names to the table header; and 6) the Summary Output Report form as the default output tab displayed.

Add a crop yield report to the WEPS 1.0 output tabbed options.

Add a management summary report to the WEPS 1.0 output tabbed options.

Revise the Output Summary Report form to meet NRCS needs. A summary of the management rotation and the longterm and rotation year soil loss estimates will be added to the report. The "notes" section will be editable from this report form to allow post-run information to be recorded. Gary Tibke will review drafts of this form.

Modify current soil property display screen to include missing header information.

Revise wind/strips input fields/methodology to prevent the user from changing barrier width, so that porosity/width relationships are maintained.

Submit the necessary documentation for NRCS to certify WEPS 1.0 as CCE compliant software.

Deliver WEPS 1.0 with the ability to store a WEPS 1.0 project and its run results wherever the user specifies. The ability to retrieve and display multiple individual WEPS run results onscreen simultaneously will be provided.

Additional interface tasks are enumerated below as individual items.

2. Complete in-house testing and validation of WEPS 1.0 to ensure the model is stable.

   a. Science functionality to be added or fixed.

Add a WEPS management operation that indicates the date a crop will be killed by freezing. The user specifies the freeze date in the management rotation file.

Correct soil layer temperature simulation problems so that freeze/thaw cycles occur as intended based upon the relationships in the WEPS 1.0 model.

   b. Science functionality that **will not** be added or changed in WEPS 1.0.
      1. No integrated "grazing" option will be provided in WEPS 1.0.

   c. Code verification testing

Verify that that the Erosion submodel code reproduces the published relationships between erosion rate and random roughness, oriented roughness, aggregate size distribution, aggregate stability, crust properties, surface wetness, standing and flat biomass, crop cover, field length, and wind barriers for 3 soils and 5 different uniform six hour wind storms.

Verify that the Hydrology submodel code reproduces the published relationships for soil water balance, evaporation, transpiration, infiltration, runoff, and deep drainage for 3 soils.

Verify that the Soil submodel code reproduces the published relationships for decay of random and oriented roughness, changes in aggregate size distribution, soil bulk density and aggregate stability, and development of crusts due to climatic influences (rainfall, wetting, drying, freezing, and thawing).

Verify that the Plant Growth submodel produces County level yield within 95% confidence level for all NRCS Core crops in locations where the crop is grown and wind erosion is known to occur.

Verify that the Decomposition submodel code reproduces the published relationships for fall of standing stems and mass decay of standing, flat, and buried residue due to moisture and temperature.

Code verification of the Management Submodel processes are performed each time a new operation is added or a current operation's parameters are modified. Therefore, testing required to complete the NRCS Core list of operations will constitute the "code verification" of the Management Submodel.

Baseline tests for WEPS 1.0 will consist of 12 cropping systems from locations covering major wind erosion susceptible regions of the US. The baseline test locations will be selected in consultation with Gary Tibke. NRCS personnel from the selected states will provide Gary with the rotation scenarios. The results will be reviewed and compared with WEQ runs.

      d. Erosion Submodel Validation Testing
         1. 47 published individual dust emission events from 7 locations in 6 states (TX, CO, KS, MO, NE, and WA) have been selected by the Global Change and Terrestrial Ecosystems Soil Erosion Network for model validation. Each of these 47 measured data sets will be reviewed to determine if they meet the minimum WEPS 1.0 Erosion submodel data input requirements. All individual dust emission data sets that meet the required criteria will be used in the testing of the Erosion submodel and reported in the results.

   3. Using the 12 baseline WEPS scenarios, WERU will report the deviation from the long-term convergent average annual soil loss values for various run lengths, including the "Standard NRCS WEPS1.0 simulation" run length as described in Section A4. A report will be generated that documents the "stability" and "consistency" of WEPS 1.0 based upon these runs. This will give NRCS information pertaining to the tradeoffs between degrees of "consistency" and "stability" vs. simulation runtime. The "stability" and "consistency" goal for WEPS 1.0 is plus or minus 20% of the long-term convergence value (or 1 ton/acre/yr when erosion estimates are less than 5 tons/acre/yr) for "Standard NRCS WEPS 1.0 simulation" run lengths.

   4. The number of rotation cycles necessary for a "Standard NRCS WEPS 1.0 simulation" will be determined based upon the 12 baseline WEPS 1.0 scenarios on a standard NRCS CCE compliant computer (see Attachment 2). The average run time of these scenarios will not exceed 30 seconds per rotation year.

Provide initial CORE crop, operation, and wind barrier databases. The operation and wind barrier databases will be delivered as is at time of execution of this agreement. ARS will increase the crops database to include the 30 crops listed in Attachment 3. The

crops database is provided by ARS for use in the testing phase of this Agreement. This initial crops database is not intended to be applicable to the growth of all listed crops in all regions of the country. **NRCS understands that the crops database will need to be populated with growth data for crop varieties specific to geographic regions. The population of the crops database with this additional information is NRCS' responsibility.**

Deliver WEPS 1.0 with a set of "control files" that only allow user access to an NRCS specified subset of crop and operation database parameters with all textual errors corrected. Gary Tibke will work with ARS scientists and the NRCS database manager to determine the database parameters to be displayed with in the drilldown screens and their respective editing attributes.

Deliver WEPS 1.0 with the ability to read from and write to an XML file format that consists of an operation date (month, day, and rotation year), operation name, and planted crop name. This will allow NRCS to build multiple year rotations from single and/or multiple year records in either RUSLE2 or WEPS 1.0 and use them in either model. Both ARS and NRCS understand that some management rotation sequences must be specified differently in WEPS and RUSLE2 for the rotations to be correctly simulated due to differences in the two models. In those cases, the user will need to edit these scenarios appropriately after transferring them from one model to the other via the XML file conversion format. **It is NRCS' responsibility to ensure that crop and operation names are the same between RUSLE2 and WEPS 1.0 to maximize the benefit of this feature.**

8. Provide WEPS 1.0 users with the option to specify "yield as an input". This feature will allow the user to specify yield for local plant growth calibration purposes. When WEPS runs in the "yield calibration" mode, the user-specified target yield will be met for those crops with the specified soil, management rotation, and location.

9. Deliver WEPS 1.0 with windgen and an updated database derived from NCDC's quality reviewed 1st order military, NCDC, and other US weather station data. Specific tasks to be completed are:

Complete program to convert historical wind data into statistical windgen data records. Update the current windgen database with recent "quality reviewed" NCDC data. Test windgen program to verify that it gives statistically accurate representations of the windgen database records. The determination of statistically accurate representations of the windgen database records is solely ARS' responsibility.

10. Deliver WEPS 1.0 with a default selection of the windgen station closest to the location specified for a WEPS 1.0 run. In the event that NRCS training and policy require that a different windgen station be used, the users will have the ability to select another windgen station. The decision to use the default selection or change the selection will be addressed by NRCS in training.

11. ARS understands that it is important for NRCS to be able to access NRCS' SSURGO soils database. ARS will provide WEPS 1.0 with the ability to connect

to the SSURGO database. The user will have the ability to choose a soil type from that database. WEPS 1.0 will not pre-screen the soil types for the required modeling information. WEPS 1.0 will screen the user's soil selection for the model-required information. If the required information is not available for that selection, WEPS 1.0 will inform the user that the selection has insufficient information and ask for another selection.

Deliver WEPS 1.0 with output that reflects the effect of downwind barriers on soil movement. Users will be able to select a wind barrier, which most closely represents their field condition from the database. WEPS 1.0 will also include additional output to better reflect the aggregate on-field effects of field size changes due to strip cropping and other "field size reduction" management practices. The specific task to be completed is to modify WEPS soil loss accounting to report soil loss over areas with a net soil loss and within field deposition over areas with net deposition.

B. NRCS' RESPONSIBILITIES:

1. Prepare a testing plan for WEPS 1.0. Both parties must mutually agree to this plan. The plan will be discussed and approved at the second quarterly meeting of Phase One.

C. ARS and NRCS MUTUAL RESPONSIBILITIES:

1. Hold quarterly update meetings. Specific meeting agenda items are:

    a. 1st quarter (End of September 2002)
        1. Phase 1, section 1 to be completed are: a, e, f, g, h, j, k, l and m.
        2. Phase 1, section 2 to be completed are: a1, and c6
        3. Phase 1, section 5, 6, 7, and 11 are to be completed.
    b. 2nd quarter (End of December 2002)
        1. Discuss and approve NRCS' testing plan.
        2. Phase 1, section 1 to be completed are: b and d.
        3. Phase 1, section 2 to be completed are: c1 and c4.
        4. Phase 1, sections 9a and 1p are to be completed.
    c. 3rd quarter (End of March 2003)
        1. Phase 1, section 1 to be completed are: i and n.
        2. Phase 1, section 2 to be completed are: c2, c5, and d1
        3. Phase 1, sections 9b, 9c, and 12a are to be completed
    a. 4th quarter (End of June 2003)
        1. Phase 1, section 1 to be completed are: c and o.
        2. Phase 1, section 2 to be completed are: a2, c3, and c7.
        3. Phase 1, sections 3, 4, and 8 are to be completed.

PHASE TWO: WEPS 1.0 TESTING
Start Date: July 1, 2003
End Date: June 30, 2004

A. ARS' RESPONSIBILITIES:

Provide technical support during testing including, but not limited to, training the NRCS testers and debugging WEPS 1.0.
Develop a "how to" guide to assist NRCS in populating the crops database.
Develop a "how to" guide to assist NRCS in populating the management operations database.
Develop a "how to" guide to assist NRCS in populating the wind barrier database.
Revise the WEPS 1.0 technical documentation.
Develop strip crop tutorial for WEPS 1.0.
Replace the Java 3rd party table component.

B. NRCS' RESPONSIBILITIES:

1. NRCS will oversee the testing and communicate any concerns or bugs to ARS in a timely manner. **NRCS agrees not to distribute WEPS 1.0 to anyone not approved in the agreed to testing plan.**

C. ARS and NRCS MUTUAL RESPONSIBILITIES:

1. Hold quarterly update meetings on testing. Specific meeting agenda items are:

    a. 1st quarter (End of September 2003)
        1. Phase 2, sections 2, 3, 4, 5, 6, and 7 to be completed.
        2. Technical documentation to be completed.
    b. 2nd quarter (End of December 2003)
        1. Discuss testing results.
    c. 3rd quarter (End of March 2004)
        1. Discuss testing results.
        2. Discuss implementation
    a. 4th quarter (End of June 2004)
        1. Discuss testing results.
        2. Finalize implementation plan.

General Provisions

1. Content of WEPS 1.0
   The final decision as to the content of WEPS 1.0 rests solely with ARS.

2. Termination

This Agreement, or parts thereof, is subject to termination at any time by mutual consent. Either party may unilaterally terminate this entire Agreement at any time by giving the other party written notice not less than sixty (60) calendar days prior to the desired termination date.

3. Amendment

If either party desires a modification in this Agreement, the parties shall confer in good faith to determine the desirability of such modification.
Such modification shall not be effective until a written amendment is signed by the Authorized Agents of both parties.

4. Entire Agreement

   This Agreement constitutes the entire agreement between the NRCS and ARS and supersedes all prior agreements and understandings between them with respect to its subject matter.

Any representation, promise, or condition in connection with such subject matter which is not incorporated in this Agreement shall not be binding upon either party.
No modification, renewal, extension, waiver, or termination of this Agreement or any of its provisions shall be binding upon the party against whom enforcement of such modification, renewal, extension, waiver, or termination is sought, unless made in writing and signed on behalf of such party by that party's Authorized Agent.
As used herein, the word "termination" includes any and all means of bringing to an end prior to its expiration by its own terms of this Agreement, or any provision thereof, whether by release, discharge, abandonment, or otherwise.

ACCEPTED FOR ARS: **ACCEPTED FOR NRCS:**

_____   _____
_____
Name: **Name:**

_____   _____
Title   **Title**

_____   _____
Date   **Date**

ATTACHMENT 1

WEPS User's Guide Table of Contents

ATTACHMENT 2

**STANDARD CONDITIONS AND COMPUTER HARDWARE
REQUIREMENTS TO USED TO DETERMINE RUN TIME**

Issue Description:
One of the concerns for WEPS 1.0 is the amount of time it takes to make a single simulation
run. There are several components of a WEPS run which contribute significantly to the total
runtime. Each of these components needs to be investigated to determine their contribution to
runtime and the potential to reduce the total runtime. Runtime issues are somewhat nebulous
because it is not only the efficiency of the written code to simulate the processes in the model,
but also dependent upon the user's perception of what is an acceptable time to wait for a run to
complete, the speed of the computer being used, the specific conditions/inputs for each
particular simulation run, the optimization efficiency of the compiler, etc. As an ongoing
process, the goal is to continue to improve runtime over the long term. Specific runtime
guidelines and/or targets can be specified under a specified set of baseline conditions and usage
goals, with the realization that a certain level of variability will exist because of these runtime
restrictions.

Outline of Planned Solution:
NRCS has requested that WEPS 1.0 run a maximum of 30 seconds per rotation year for an
"NRCS standard WEPS 1.0 run". For example, a wheat/fallow 2 year rotation run would require
no more than 1 minute (30s x 2) to obtain an answer, a four year crop sequence would require
no more than 2 minutes (30s x 4), etc.

Since NRCS has stated the WEPS 1.0 runtime goal, ARS will determine the number of years
per rotation year that can be completed within that time limit. The 12 baseline scenario WEPS 1.0
runs (developed previously for WEPS 1.0 testing) will be used to determine that number. The
average of the number of years per rotation year completed within 30 seconds from those
WEPS 1.0 baseline runs will be the value used to define an "NRCS standard WEPS 1.0 run". The
hardware used to do the test will be an NRCS CCE compliant PC (850MHz Pentium 4
machine with 256MB of RAM running Windows NT).

ATTACHMENT 3

NRCS CORE Crops Database

Alfalfa
Asparagus
Bean, green snap
Brocolli
Bromegrass
Cabbage
Canola
Carrots
Corn, grain
Corn, Silage
Cotton, picker
Cotton, stripper
Lentils
Oats, spring
Onions
Peanuts
Peas
Potato, white irish
Safflower
Squash
Sorghum, grain
Soybeans
Sugar Beets
Sugar Cane
Sunflower
Tall Fescue, pasture
Tobacco
Wheat, Spring
Wheat, winter
Wheat, winter NWRR